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The Influence of Anxiety Level, Eye Movement and Type of Information on an Eyewitness' Memory of a Crime.

By Chloe Blunsdon

The Influence of Anxiety Level, Eye-Movement and Type of Information on an Eyewitness' Memory of a Crime.

ABSTRACT

Eyewitness testimony is widely used as evidence in court (Weber and Brewer, 2008) However, many factors that influence a witness' memory of a crime means that the credibility is questionable, which can have huge repercussions on the conviction of criminals (Albright, 2017). Examples of those factors include a person's level of anxiety (Easterbrook, 1959) and eye movement (van den Hout and Engelhard, 2012) at the crime scene. This study aims to look at level of anxiety, eye movement and the type of information and their influence on eyewitness memory, by investigating the number of correctly answered central and peripheral questions in high and low anxiety level groups, and horizontal, vertical and none eye movement groups. The study used an opportunity sample of 30 people between the ages of 18 – 50. Two mixed ANOVA's revealed a non-significant interaction between the level of anxiety and the correctly answered central and peripheral questions relating to the crime. Subsequently, there was a non-significant interaction between the type of eye movement and the correctly answered central and peripheral questions. The findings are discussed with relation to future research.

KEY WORDS:	EYE MOVEMENT	ANXIETY	EYE WITNESS MEMORY	CENTRAL AND PERIPHERAL	RECALL
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1. Introduction

Eyewitnesses are a vital part of criminal convictions and trials (Weber and Brewer, 2008), as they are the main, and sometimes the only, source of information regarding what happened during a crime that has been witnessed (Wells and Olson, 2003). For example in the US, 77,000 people a year are suspects in a case due only to the identification by an eyewitness as evidence (Goldstein et al, 1989). However, it is widely recognised that there are frequent errors in event recollection (Read, 2006) and research has shown that a great deal of the information recalled lacks reliability and accuracy (Theunissen et al, 2007). For example, many people have been released from prison due to wrongful conviction since DNA testing, and up to 75% of these convictions were based on eyewitness testimony (Scheck et al, 2000).

Proposed, are many reasons for this, such as stress and perpetrator race (Sonenshein and Nilon, 2010), emotional arousal (Davidson and Vanegas, 2015) and the type of information within a crime scene (Laney et al, 2004). Thus, when DNA isn't present at a crime scene, eyewitnesses are the next best resource for conviction, and so understanding the factors that affect accurate information recall about crimes is important, to understand and reduce error in eyewitness testimony (Thorley, 2013). The current study focuses on whether three aspects, anxiety level, eye movement, and central and peripheral information, show a difference in the number of correctly answered questions regarding a video of a crime.

1.1 – Anxiety

One factor of particular interest that has been suggested to influence the memory of a crime is anxiety. Anxiety can be defined as 'excessively fearful, anxious or avoidant of perceived threats in the environment' (Craske and Stein, 2016: 3048). Anxiety is said to have an impact on emotional interference (Bar-Heim et al, 2007), which in turn affects memory processing (Dresler et al, 2009). To elaborate on this, Hoehn-Saric and McLeod (2000) found that in cases of moderate anxiety, a person's attention has been known to increase; however, too high a level of anxiety can decrease these effects (Hoehn-Saric and McLeod, 1990). This is because higher levels of emotional arousal cause less attention to be paid to cues and a narrowing of attention, reducing information processing and performance on recall tasks (Easterbrook, 1959). Many studies have found this anxiety effect to influence the recall of information at a crime scene specifically, as when a crime scene triggers a person's anxious state, this may lead to processing interference, reducing the accuracy of eyewitness memory (Wilson et al, 2007).

Christianson et al (1992) conducted a review on anxiety literature, but found a mix of results regarding anxiety influencing the accuracy of information recalled. For example, in the review was a study by Clifford and Scott (1978) whereby participants were shown a video of a violent and a non-violent crime, finding that the witnesses for the violent video had worse recall on 40 questions relating to what they had watched, indicating that a video producing higher emotional stress led to worse information processing. However, a further study by Clifford and Hollin (1981) which had the same method but where there was one, three or five perpetrators, found that when asked to describe the people seen in the video, recall was higher for the non-violent video, but recall for the violent video only decreased when there was more than one perpetrator. Furthermore, there was no difference in recall rates for

information regarding the victim, which should also be seen as central information at a crime scene. This questions the accuracy of whether anxiety levels do affect the accuracy of recall, or to what extent this interference in recall is caused.

A meta-analysis looking at stress level influence on eyewitness memory found that high stress levels impacted the recall accuracy of crime-related details in a negative manner (Deffenbacher et al, 2004). The considerations of this study were to look at individual differences such as anxiety levels which influence a person's ability to recall information about a witnessed crime. Studies that have considered this includes Nolan and Markham (1998), whereby participants completed an anxiety scale two to six weeks prior to the eyewitness task, which categorised them into either high or low anxiety, and completed a questionnaire on the video one week after viewing it. Here, they found no difference in accuracy of recall between high and low anxiety participants. They however proposed that in a real eyewitness situation, there might be a heightened state of anxiety, which a video cannot accurately replicate as it does not produce the same levels of stressfulness as witnessing a real crime. Likewise, this study would not have noticed the situational anxiety due to the fact that the anxiety scale was completed before partaking. This has also been called upon by Dresler et al (2009) who said that it is unclear whether the effects of trait or state anxiety are what cause the emotional inference. This shows mixed findings on whether anxiety does cause a distortion in eyewitness memory.

1.2 - Eye Movement

Another consideration in the effects of memory recall is the performance of eye movements (Lee and Cuijpers, 2013). When a person engages in eye movements before recall, the vividness of the memory is said to become weakened and vague, causing susceptibility to misinformation (Houben et al, 2018). This is due to the requirement of memory capacity that eye movements need, causing a dual task situation, leading to interference with recall (van den Hout and Engelhard, 2012). This interference can cause misinformation in a questionnaire, especially when the information is related to the experienced event, to be easily accepted (Otgaar et al, 2016), potentially leading to worsened recall. Therefore, it can be assumed that using this activity in laboratory settings may attempt to substitute the interference of the environment on the recall of a crime, which can have implications for eyewitness testimony and the conviction of a criminal.

Van den Hout et al (2014) conducted a study looking at participants who had to recall a personal experience, either a neutral or emotional one, and rate it on a scale of vividness and emotionality. They were then allocated to either the 'recall only', or the 'recall and eye movement (EM)' condition, whereby the recall only had a stationary dot task and the recall and EM had a dot that moved vertically. They were to rate their memory, watch 6 cycles of the dot condition and then rate their memories again. This research found that the EM group had reduced vividness and emotionality of their memory, when recalling an emotional experience, in the second ratings. The researchers put this down to the emotionality of a memory facilitating the blurring of EM and causing the memory to become vague. A further study looked at the influence of eye movement on misinformation acceptance, showing undergraduates a car crash clip, followed by either an eye movement or keeping

their eyes stationary, and finally filling in a questionnaire that contained some misinformation questions (Houben et al, 2018). They found eye movement participants to be more susceptible to misinformation, and produced less accurate answers. This proposes the adverse effects of eye movement on memory, and the potential influence eye movement can have when recalling a crime.

Contradictory findings have found that these eye movements in fact increase the recall of memories, as the movement is seen to increase the interaction between brain hemispheres (Baken and Svoran, 1969), thereby improving episodic memory (Parker et al, 2008). Lyle and Jacobs (2010) showed participants slides of crimes and then gave contradictory or additive misinformation, followed by either bilateral saccades or a fixation, before information recall. The study found that viewing the saccade increased the recall of event memories, and the distinction between seen and unseen information, therefore suggesting that eye movements could in fact increase the recall of information at a crime scene, challenging previous research suggesting otherwise.

1.3 - Central and Peripheral Information

A further influence on the accuracy of recalling details from a crime is the type of information within the witnessed event. There are two main types of information: central information is any fact that is essential to the witnessed crime; peripheral information is that irrelevant to the main event (Christianson et al, 1992). When witnessing a crime, a person's memory for information central to the event is said to improve, while memory for peripheral information decreases (Laney et al, 2004). Heuer and Reisberg (1992) said that central information is more distinguishable than peripheral information, leading to our attention being focused on these aspects of a crime, ultimately enhancing our recall about them. Research supporting this found that witnesses better identified a criminal (an obvious central item) than peripheral items in the study (Wells and Leippe, 1981). Luna and Migueles (2009) found that central information recall was better than peripheral information recall after viewing a video of a bank robbery, completing a distractor task and then filling in the questionnaire, research similar to the present study. This can also be linked to the effects of arousal at a crime scene, as shown by Kramer et al (1990) who did two studies relating to weapon focus effect, arousal and memory. In study one, the participants witnessed a crime where the weapon was either clearly, or hardly, visible. Findings indicated that clearly seeing the weapon negatively affected descriptions of the perpetrator, which they believe is due to fixation on the weapon when exposed to it, demonstrating that arousal can cause main central items in the crime to be focused on. The second study involved participants looking at photo slides then explaining what they saw, finding that the weapon condition led to 100% object recall accuracy, further supporting the enhanced recall effects for central information.

Contradictory findings, however, do exist amongst this area of research, as Migueles and Garcia-Bajos (1999) did a study by which participants watched a kidnapping and had to recall central and peripheral actions and details about what they had seen. Results showed no difference between the amount of central and peripheral information recalled, however central actions were recalled much more than central details, with no difference found within peripheral. This challenges many studies

findings' that focus on the general recall of both types of information, but does indicate that it may be more complex than just two aspects of information that a participant's attention is distributed to. Subsequently, Wessel et al (2000) got participants to watch either emotional, unusual or neutral slides with a central and peripheral piece of information in each, finding that there was no impaired recall between the central and peripheral information for the emotional condition, despite having more eye movement towards the central information. Furthermore, there was actually a bigger correlation between fixation on the peripheral information and recall, which wasn't found with central, demonstrating no correlation between the allocation of attention and recall of either types of information.

1.4 - Rationale

In light of these findings, it has been suggested that there are many factors that can impact the accuracy of eyewitness testimony. With reference to anxiety, Deffenbacher et al (2004) demonstrated that a state of emotional arousal and stress at a crime scene is generally seen to worsen the recall of information relating to the crime itself. However, such research looking at high and low anxiety levels found no difference (Nolan and Markham, 1998); this study did however calculate anxiety scores prior to the study taking place, and so the present study fills the gap of looking at anxiety scores calculated after watching the video of the crime. Thus, this will look at participant's current anxiety level, and assess high and low anxious participants that Deffenbacher et al (2004) suggested, hoping to produce more applicable results.

The suggestion that central and peripheral information have different amounts of attention paid to them when witnessing a crime has received substantial support (Well and Lippé, 1981; Luna and Migueles, 2009), although not all has been in favour of central receiving more (Wessell et al, 2000). There is research looking at arousal causing this divided attention, but none linking the specific category of high and low anxiety and how this may differ between the two types of information, giving further reason for the present study's rationale. Furthermore, the stated eye movement literature does not address the potential impact of such eye movement's on recalling different types of information, which is what the present study aims to look at. Also, with eye movement research previously finding interference in the recall of memories, it is of high significance in terms of eyewitness testimony and its implications.

Thereby, not only will this study be one of few in this field to look at the three variables discussed, but will also fill a potential gap in the knowledge surrounding eyewitness memory influences and their implications on recall.

Hypothesis 1 – There will be an interaction between low and high anxious participants and the number of correctly answered central and peripheral questions.

Hypothesis 2 – There will be an interaction between watching either the horizontal, vertical or none eye movement and the number of correctly answered central and peripheral questions.

2 Method

2.1 - Design

The designs used to analyse the data collected were two mixed ANOVA's. One ANOVA was a 2 x 3 mixed factorial design, whereby the within participants' variable was the correctly answered questions relating to the type of information (central vs peripheral), and the between participants' variable was the eye movement observed (horizontal, vertical, none). Furthermore, a 2 x 2 mixed factorial design was conducted, whereby the within participants' variable was, again, the correctly answered questions relating to the type of information (central vs peripheral), and the between participants' variable was the level of anxiety (low vs high anxiety).

2.2 - Participants

This study recruited 30 participants (23 females, 7 males, mean age = 22.53, $SD = 6.056$, age range = 18-50). They were recruited using opportunity sampling on the Manchester Metropolitan University participation pool. An electronic advertisement letter was used (see appendix 2) which was posted to inform people about, and invite people to take part in, the present study. This method was the most appropriate for the study as giving people the choice to take part means that they are willing to participate and are readily available (Etikan et al, 2016), however it is likely to be biased (Mackey and Gass, 2005). The inclusion criteria for this study was that participants were to be at least 18 years of age. The exclusion criteria was that people were unable to take part in the study if they had previously witnessed a serious crime in real life, as the experiment could be upsetting for them.

2.3 - Materials

One material used during the study was a handiness questionnaire, which consisted of questions to do with using either hand for certain activities (appendix 3); this task was purely to distract the participant so they did not fully understand the aim of the study until they were debriefed (ethical considerations were implemented here). Moreover, a short video clip of a crime called 'The Stick-Up Bank Robbery' was used. This video contained a robber, who was wearing a clown mask, entering a bank with a large gun and stealing money. A sheet containing questions relating to the video was also used, including ones such as 'did the robber pull his gun out before entering the bank?' (appendix 4). Luna and Migueles (2009) previously created these questions, with eight questions relating to central, and eight questions relating to peripheral, information. Along with the question sheet, a response sheet was given out whereby the participants were to answer 'yes' or 'no' to each question, and then select whether they chose the answer because of recollection ('remember'), of a feeling of familiarity ('know') or merely a guess ('guess') (appendix 5). A further material used was a list of mathematical equations used as a mental distractor task to decrease memory rehearsal of the video, which was created primarily for the study. Finally, the BIS-Anxiety items (Carver and White, 1994) from the International Personality Item Pool was used to form the anxiety questionnaire, with items such as 'I begin to panic when there is danger', to measure participant's anxiety levels and its influence on their memory of the video (appendix 6). This anxiety scale has a Cronbach's alpha level of 0.84, considered to be high (Hinton et al, 2014). Furthermore, items 5 and 10 were reverse scored upon analysis preparation due to being positively worded, compared to the rest being negatively worded. This was to reduce response bias and careless answers amongst the participant's responses (Wu, 2008).

2.4 - Ethical Considerations

There were a couple of ethical guidelines considered in this study. The British Psychological Society (2009) has an ethical code for psychology researchers to abide by, as well as Manchester Metropolitan University having their own set of rules, which must be met, in order to protect the safety of participants. Firstly, a consent form was provided for the participants, which included a number of requirements they were to tick and agree with, followed by signing the form (appendix 7). This was to ensure that the participant had consented to taking part before the experiment started. In the consent form, the participants were informed that all of their responses were to be stored confidentially and anonymously, using a unique identification code that they created at the end of the study. Additionally, they were reminded that they could withdraw from the study at any point, until the date stated on the sheet.

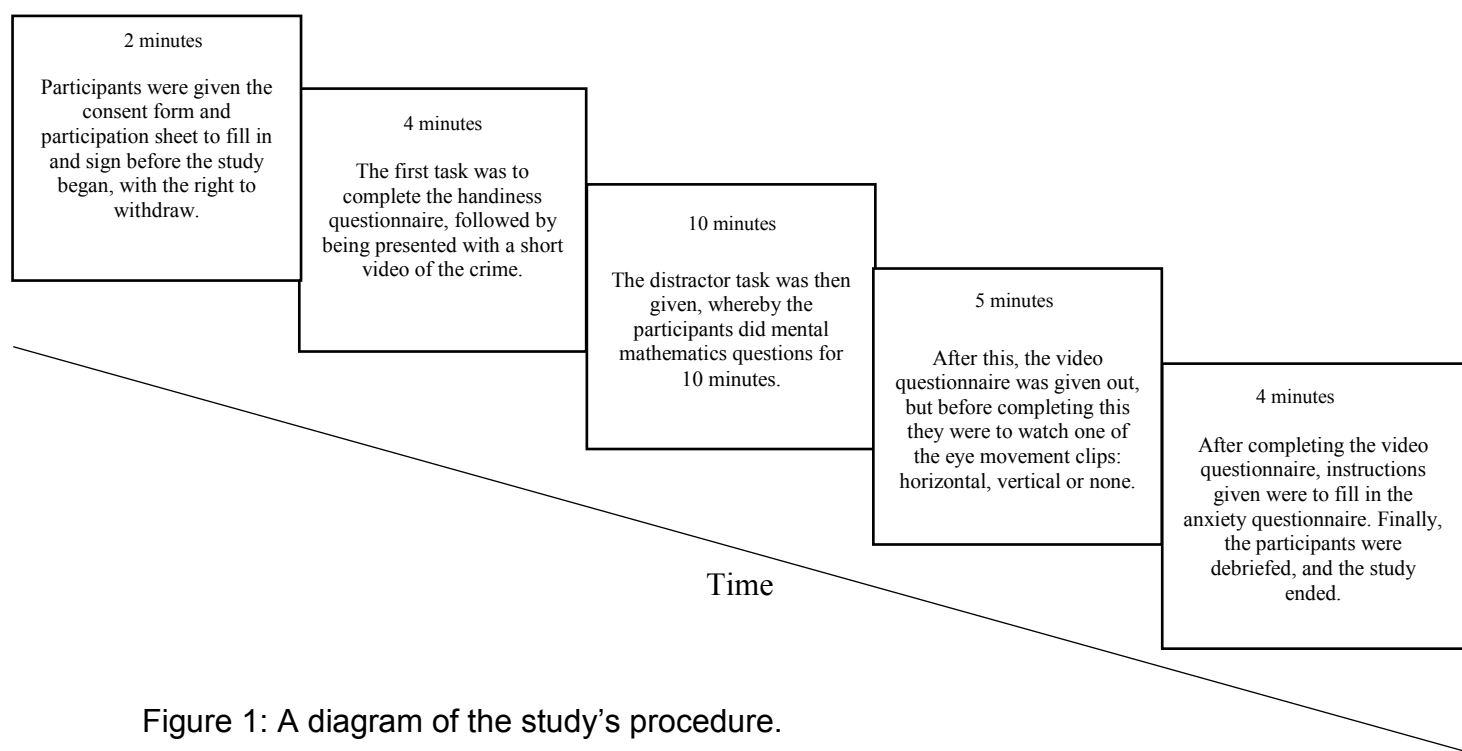
One of the main ethical considerations in this study was the use of deception, as to effectively conduct the study, the participants could not be told the full purpose before participating. This was due to the nature of the experiment whereby if they were told the exact activities and reasons for completing them, there would be a risk of demand characteristics, which could have influenced the results. To overcome this, the participants were fully debriefed with the reasons for deception and the intentions of the experiment (appendix 8), and they were offered support and the option to withdraw if they wanted to after completing the study.

Furthermore, due to the nature of the experiment and it containing a video of a bank robbery, the exclusion criteria was that participants who had previously been a witness to a crime that they found disturbing were not allowed to take part. This was for their own protection, as watching the video may have triggered the recall of the previously witnessed crime, causing disturbance. This meant that harm to participants was avoided as much as possible. For the participants that did take part, support contacts, such as the Samaritans number, were stated during the debrief providing they felt upset or affected by anything they witnessed during the experiment.

2.5 - Procedure

Participants were asked to meet in a quiet room in the university building, for participation protection, and told that the study would last approximately 25 minutes. They were given a participant information sheet (appendix 9) and a consent form (appendix 8) to read through and then sign, with any questions being answered before they took part. Once the form was signed, they were given the right to withdraw from the study, and reminded that any results would stay anonymous throughout, and after, the study was conducted. Firstly, the participants were to complete the handiness questionnaire. After this, they were shown the short video clip of the bank robbery extracted from a film and then given the list of mathematic equations to solve for a duration of 10 minutes, which was timed. When the 10 minutes was over, the response sheet was given and they were instructed to complete it with regards to the video they had previously seen, being sure to give a 'yes' or 'no' answer and whether they 'knew', 'remembered' or 'guessed' their

response. Just before answering the questions, they watched an eye movement clip, which was either the 'horizontal', 'vertical' or 'none' condition. Subsequently, they completed the BIS anxiety questionnaire scale that measured their anxiety level, filled in some simple demographic questions and then were debriefed to explain the full purpose of the study and any questions were answered. Finally, they made a unique identification code to store their results with, and the study then ended.



2.6 - Pilot Study

Prior to conducting the research, a pilot study was run to test the study's procedure, material and timings. Pilot studies are valuable to research as when they are well conducted, they 'encourage methodological rigour' and ensure validity within the study (Lancaster et al, 2002: 307). Carrying out a pilot study meant that the timings could be confirmed in order to advertise the study accurately to potential participants. Furthermore, this enabled assessment of the chosen materials to be carried out to ensure they were suitable for the present study and would produce accurate results. For example, before the pilot study, there was a debate of whether the eye movement clip should have been shown before or after the mathematical distractor task, but the pilot study resolved this.

3. Results

The data from Gray's BIS anxiety scale (Carver and White, 1994) and the video questionnaire were inputted into SPSS v.24.0.

3.1 - Preparation of the Data

The data was checked to see if the parametric assumptions were met. Levene's test showed that the variances for the correctly recalled peripheral information questions and anxiety group were equal, $F(1, 28) = 2.31, p = .140$ as were the correctly recalled central information questions and anxiety group, $F(1, 28) = .55, p = 0.464$. Furthermore, the variances for the correctly recalled peripheral information questions and eye movement were equal, $F(2, 25) = 1.45, p = .253$, however the variances for the correctly recalled central information questions and eye movement were not equal, $F(2, 25) = 5.45, p = .011$. The data was also checked for outliers, finding only one outlier, participant 4, who was in the horizontal eye movement condition and scored higher than the other participants on the correct number of peripheral questions answered.

Two of the items, question 5 and 10, on the anxiety questionnaire had to be reverse scored prior to calculating each participant's total anxiety score (explained in the materials section). Once these were reversed, the total anxiety score was calculated, and the median was found, allocating them to an anxiety group; below 35 was considered the low anxiety group ($N = 13$), above 35 was considered the high anxiety group ($N = 17$).

3.2 - Type of Information vs Eye Movement

The first ANOVA conducted was a 2×3 mixed design ANOVA, with the within-subjects factor being the type of information (central vs peripheral) and the between-subjects factor of eye movement (horizontal vs vertical vs none). The dependant variable was the number of correctly answered questions. Below, in Table 1, are the descriptive statistics for this analysis, containing the means, standard deviations and confidence levels.

Table 1

Means, standard deviations and confidence levels of correct central and peripheral answers when observing one of the three eye movement clips

Eye movement	Word type	Mean	Standard deviation	95% confidence level	
				LB	UB ¹
Horizontal	Central	6.30	0.48	5.508	7.092
	Peripheral	4.00	1.83	3.063	4.937
Vertical	Central	6.33	1.66	5.498	7.168
	Peripheral	4.89	1.45	3.901	5.877
None	Central	6.89	1.27	6.054	7.724
	Peripheral	3.89	0.78	2.901	4.877

¹ LB = Lower Bound, UB = Upper Bound.

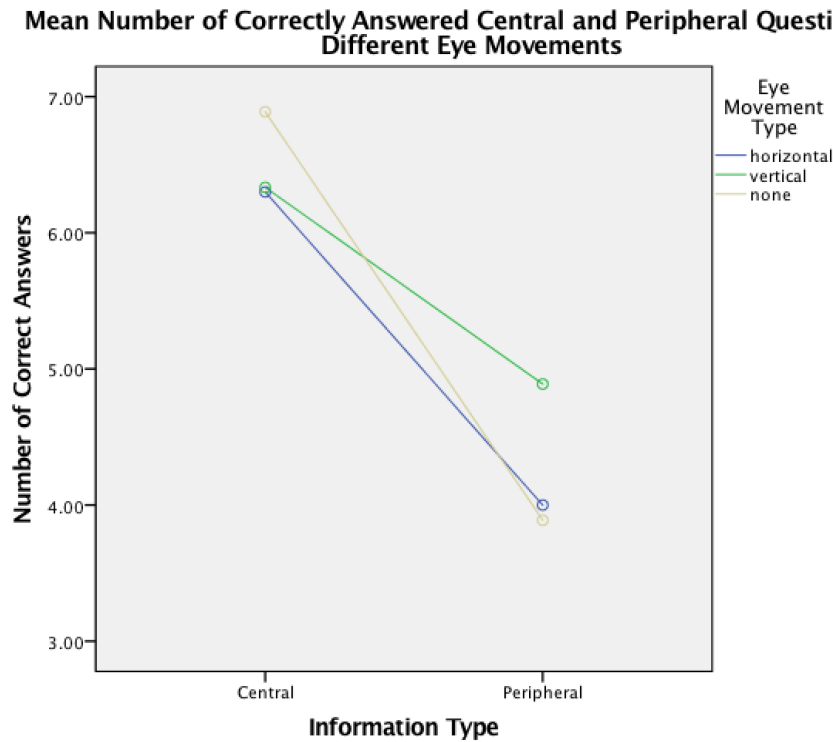


Figure 2: A graph to show the mean number of correct central and peripheral answers in each eye movement type.

The main effect of eye movement was non-significant, $F(2, 25) = .45$, $p = .640$, $\eta_p^2 = .035$. however there was a significant main effect in the type of information, $F(1, 25) = 52.21$, $p < .001$, $\eta_p^2 = .68$. There was no significant interaction between the type of information and eye movement, $F(2, 25) = 2.06$, $p = .149$, $\eta_p^2 = .14$, shown in appendix 10.

3.3- Type of Information vs Level of Anxiety

The second ANOVA was a 2 x 2 mixed design ANOVA, with the within-subjects factor being the type of information (central vs peripheral) and the between-subjects factor being the level of anxiety (low vs high anxiety). The dependant variable was the number of correctly answered questions. Below, in Table 2, are the descriptive statistics for this analysis, containing the means, standard deviations and confidence levels.

Table 2

Means, standard deviations and confidence levels of correct central and peripheral answers for low and high anxiety groups

Anxiety group	Word type	Mean	Standard deviation	95% confidence level	
				LB	UB ²
Low anxiety	Central	6.15	1.41	5.460	6.848
	Peripheral	4.77	1.69	3.935	5.603

² LB = Lower Bound, UB = Upper Bound.

High anxiety	Central	6.59	1.06	5.981	7.195
	Peripheral	4.00	1.28	3.271	4.729

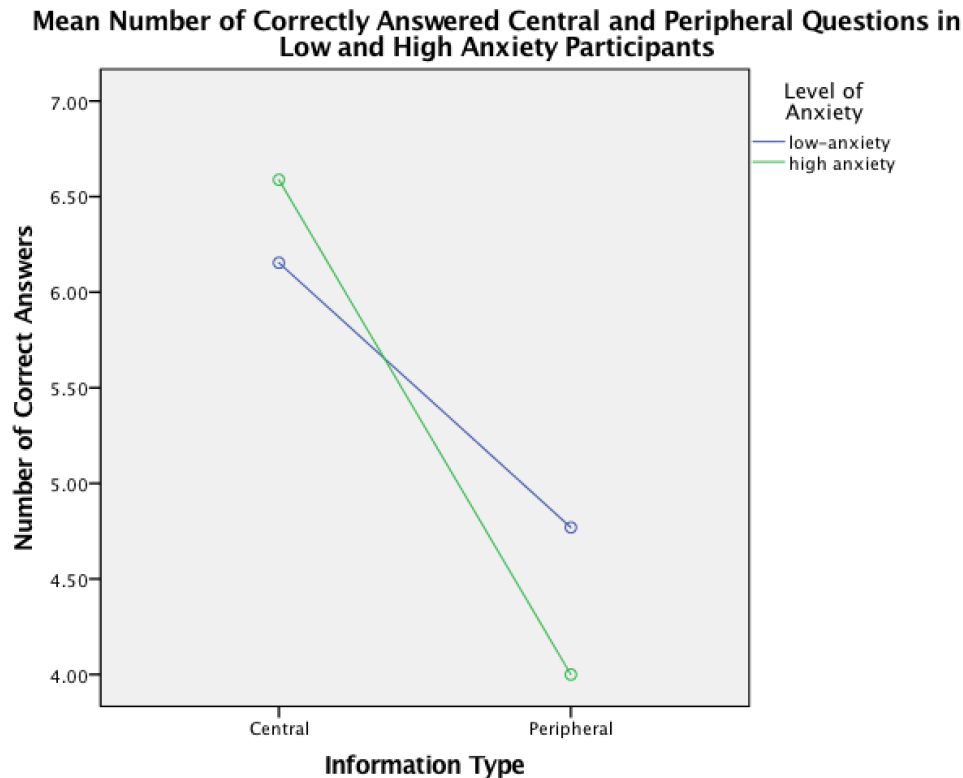


Figure 3: A graph to show the mean number of correct central and peripheral answers in high and low anxiety participants.

The main effect of the level of anxiety was non-significant, $F(1, 28) = .194$, $p = .663$, $\eta_p^2 = .01$, however there was a significant main effect for the type of information, $F(1, 28) = 38.21$, $p < .001$, $\eta_p^2 = .57$. There was a non-significant interaction between the type of information and the level of anxiety, $F(1, 28) = 5.34$, $p = .072$, $\eta_p^2 = .11$, shown in appendix 10.

4. Discussion

The aim of this study was to investigate the effects of anxiety level, eye movement and central and peripheral information on eyewitness memory. The study hypothesised that there would be differences between low and high anxiety participants and their number of correctly recalled central and peripheral information questions, and between either watching the 'horizontal', 'vertical' or 'none' eye movement clip and the number of correctly answered central and peripheral questions. The results, however, found a non-significant interaction between both the level of anxiety and the type of eye movement, and the number of correctly answered central and peripheral information questions. There was also a non-significant difference between the level of anxiety, as well as between the type

of eye movement clip. Despite this, a significant difference between the number of central and peripheral information questions correctly answered was found, with central information being better recalled. The results are discussed with reference to the studies reviewed in the introduction, the limitations and implications are identified, and future recommendations for research in this field are considered.

4.1 – Wider Context

The current study's results have both supported and contradicted previous research in this area. With both hypotheses being rejected, and the interactions being non-significant, this brings about a new insight to the influences on eyewitness memory.

Research has shown that, generally, emotional interference and anxiety have been associated with impaired memory recall of a crime (Deffenbacher et al, 2004; Clifford and Scott, 1978). Nonetheless, the current study found no interaction between the low and high anxiety group and their correct number of central and peripheral answers recalled, which research by Nolan and Markham (1998) supports. Nolan and Markham (1998) demonstrated no difference between low and high anxiety participants and their recall on a crime video, which is comparable to the present study. The current results also give support to Dresler et al (2009) who stated that different types of anxiety may be causing memory interference, which would explain these non-significant results, as there was no clear distinction between whether trait or state anxiety influenced the current recall rates. Therefore, the type of assessment for anxiety may be causing the non-significant interaction, potentially needing revision. Furthermore, the present findings contradicts Kramer et al (1990) who found that when a weapon was present, which is central information and causes arousal, recall about that aspect of the scene increased, and other central aspects were decreased, which is what was partially hypothesised; this does however support the significant difference between central and peripheral information, as the weapon was central information and evidently had more attention paid to it. Hoehn-Saric and McLeod (2000) stating that moderate anxiety increases attention, and too high a level decreases it, may be the explanation for this overall non-significant interaction. The present study however does not induce a considerable increase in emotional arousal, especially compared to a real world situation. This could potentially be the cause of the non-significant finding between the recall of low and high anxious participant's number of correctly answered central and peripheral questions, as little trigger of an anxious state could suggest that attention to different types of information and memory recall was not interfered with.

It was also thought that there would be an interaction between different eye movement conditions and the number of correctly answered central and peripheral information questions, but this was likewise found to be non-significant. This goes against findings from Houbert et al (2018) who demonstrated that eye movement interfered with accurate recall and caused misinformation to be more easily accepted. However, this study only looked at the number of correct answers that the participants answered, and so looking at the number of incorrect answers would provide a better insight into the effects of misinformation in such a situation. It also goes against Van den Hout (2014) who found reduced vividness and emotionality of the emotional memory when watching a vertical or horizontal eye movement clip

before recall. Furthermore, this challenges the findings of Lyle and Jacobs (2008), who found that bilateral saccades increased memory recall of a crime.

One explanation for this finding may be that other influences in the study, such as emotional arousal, may have meant that the direct impact of the eye movement could not be examined, as Deffenbacher et al (2004) stated that high stress situations influence recall, and so the effect of eye movement influencing memory and recall may have been counteracted. This could explain why Lyle and Jacobs (2008) found a significant result, as their study involved showing only slides of a crime, whereas a video was used during the present study, which induces a slightly more realistic situation and therefore increased anxiety (Simon et al, 2012), interfering with the eye movement effects. Likewise, van den Hout et al (2014) put their findings of reduced recall of an emotional memory after watching a bilateral eye movement due to the emotionality of the memory along with the eye movement causing blurring. This might suggest that the current study needs amending as the eye movement not being carried out directly after the video was watched may have failed to properly influence the participant's memories, hence why it didn't cause an interaction, or that the emotional arousal may have interfered with the potential effects of eye movement. However, little research was found to directly study the effects of eye movement on the recall of the different types of information and their interaction on an eyewitness's memory of a crime, and so further research is needed.

The present study compliments findings by Luna and Migueles (2009) and contradicts Wessel et al (2000) as there was a significant difference between the number of central and peripheral information questions correctly answered, with central being better recalled.

4.2 - Limitations and Implications

One limitation of the current study was the small sample size used during data collection. Although the results are generalizable, the small sample questions the reliability of the results and how applicable they are to the context of eye witness testimony. The mean age for this study was 22.53 with an SD of 6.055, and so questions this study's representation of a wider eye witness population as most participants were between 20 and 25. A better study design, such as online participation, could have benefitted this research by allowing more participants to take part, due to the current method being time consuming given the short period to complete this research, limiting the number of recruits. A larger sample may have led to a stronger finding of the anxiety and type of information interaction, currently 0.73, potentially producing significant figures.

A further limitation of this study was its application to the real world. Due to the current study being within a lab, the extent to which real world settings were replicated to a satisfactory degree, in order to produce accurate results, could be questioned. For example, one of the variables was the level of anxiety of the participant, however the video shown was only a minor crime and the feeling of emotional arousal and anxiety was likely not triggered to the same extent than if someone was to witness a crime in real life (Nolan and Markham, 1998). Moreover, an eye movement clip may not have induced a big enough interference on memory

to reduce it significantly, especially after already completing a distractor task which could have reduced its effects.

The current study has potential implications. Firstly, the non-significant finding between anxiety levels and the correct number of central and peripheral questions could suggest that arousal at a crime scene doesn't influence where a person looks, especially when considering that there was a significant difference between the different information questions, indicating that there may be other factors causing this difference in attention. The absent eye movement interaction could further suggest that at a crime scene, eye movement is not a significant factor in the recall of the different types of information at the scene. Moreover, this has potential implications for an eyewitness memory when testifying, as the non-significant interactions suggests that anxiety level nor eye movement cause a difference in the recall of different types of crime scene information when in court. However, these results could be put down to the procedural problems identified, and so more research should be conducted in order to discover the possible memory enhancing techniques, as well as to reduce the influence of factors decreasing accurate memory at a crime scene. Nonetheless, there was a general difference in that people recalled central information better than peripheral, and so this can be taken positively in that the important information in a crime is more likely to be remembered when giving a statement.

4.3 – Future Recommendations

Following the limitations and implications of this study, there are some recommendations for future research. Further exploration in this field could consider the use of a more appropriate anxiety scale, such as the State-Trait Anxiety Inventory (Spielberger, 1983) in order to identify the participant's trait anxiety score against their state anxiety score, potentially leading to an improved understanding of its influence on eyewitness memory. This is because state anxiety may be more likely when witnessing a crime, due to the situation causing emotional arousal, but a general anxiety scale wouldn't have the appropriate measures to identify this. An experiment could also potentially look at eye movement clips and recall for a crime in relation to the separate categories of low and high anxiety participants, in order to see whether the influence of the other variables in the study caused the non-significant interaction, consequently exploring this aspect in more depth.

Alternatively, a three way ANOVA could have been conducted to see the relationship between all variables in the study, which may have revealed different results. Furthermore, eye tracking could more accurately identify what type of information the person fixates on when watching a crime and whether watching an eye movement clip, or their level of anxiety, influences accurate recall.

4.4 – Conclusion

Overall, the present study seems to both compliment and challenge previous research in the field, by showing a non-significant interaction between anxiety level and the type of information recalled, and between eye movement and the type of information recalled. Although the non-significant interactions mean that this study should be interpreted with caution, this could be a pinned to methodological reasons,

and so further work in this field based on the recommendations may expand our understanding of what factors do influence the memory of an eyewitness, which is detrimental to criminal cases.

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